

IN THE CLAIMS:

We claim:

1. A vascular filter system for insertion into a lumen of a vessel, said system
5 comprising:
a) a filter support structure comprising a proximal portion, a distal portion, and a plurality of struts extending therebetween, said struts further comprising proximal portions and distal portions, said filter having a smaller first diameter for insertion into said
10 lumen, and a second larger diameter for expanding to a diameter substantially equal to the diameter of said lumen and to be placed in a generally sealing relationship with said lumen;
b) a porous filter membrane connected to said filter distal portion and said plurality of struts;
15 c) deploying and releasing means operatively associated with said filter support structure, said deploying and releasing means causing said filter to be positioned in said lumen of said vessel, and causing said filter to achieve said larger second diameter;
d) anti-migration means associated with said filter support structure, said anti-migration means causing said filter to remain
20 substantially stationary in said lumen of said vessel; and
e) retrieving means operatively associated with said filter support structure, said retrieving means allowing recapture of said filter, causing said filter to achieve said smaller first diameter, and
25 allowing removal of said filter from said lumen.
2. The vascular filter system according to claim 1, wherein said filter support structure is made from Nickel-Titanium alloy.
3. The vascular filter system according to claim 2, wherein said anti-migration means comprises the chronic outward force of said Nickel-Titanium alloy.
- 30 4. The vascular filter system according to claim 1, wherein said filter support structure further comprises means to enhance the radiopacity of the device.

5. The vascular filter system according to claim 1, wherein said porous filter membrane is made from a polymeric material chosen from a group consisting of polyurethane, polyethylene or a co-polymer thereof.
6. The vascular filter system according to claim 5, wherein the pore size of
5 said porous filter membrane is in the range of from about 20 to about 300 microns.
7. The vascular filter system according to claim 1, wherein said deploying means comprises a storage tube having an proximal end and a distal end and an inner lumen, with said distal end of said filter slidably
10 insertable into said proximal end of said storage tube; said deploying means further comprising a catheter having an outer diameter and an inner diameter, a proximal end and a distal end, and an inner lumen, with said distal end of storage tube containing said filter slidably insertable into said proximal end of said catheter; said deploying means further comprising an obdurator having an outer diameter, a proximal end and a distal end, with said distal end of said obdurator
15 slidably insertable into said proximal end of said storage tube until said distal end of said obdurator is substantially in contact with said proximal end of said filter, and said obdurator is positioned to push said filter into said proximal end of said catheter, through said lumen of said catheter, and out of said distal end of said catheter.
- 20 8. The vascular filter system according to claim 7, wherein said storage tube is made from a polymeric material.
9. The vascular filter system according to claim 7, wherein said catheter is
25 made from a polymeric material.
10. The vascular filter system according to claim 7, wherein said obdurator is made from a polymeric material.
11. The vascular filter system according to claim 1, wherein said deploying means comprises a catheter having an outer diameter and an inner diameter, a proximal end and a distal end, and an inner lumen, said
30 deploying means further comprising a shaft having an outer diameter, a proximal end and a distal end, with said filter releasably attached near and detachable from said distal end of said shaft, and said catheter

coaxially disposed around said shaft and said filter, such that said catheter may be slidably retracted to deploy said filter.

12. The vascular filter system according to claim 11, wherein said catheter is made from a polymeric material.
- 5 13. The vascular filter system according to claim 11, wherein said distal end of said shaft is made from a metallic material and said proximal end of said shaft is made from a polymeric material.
- 10 14. The vascular filter system according to claim 1, wherein said deploying means comprises a guidewire having a proximal end and a distal end, with said proximal end of said filter releasably attachable near and detachable from said distal end of said guidewire; said deploying means further comprising a catheter having an outer diameter and an inner diameter, a proximal end and a distal end, and an inner lumen, with said proximal end of said guidewire slidably insertable into said distal end of said catheter until said catheter is coaxially disposed around said guidewire and said filter, and said catheter may be slidably retracted to deploy said filter.
- 15 15. The vascular filter system according to claim 14, wherein said guidewire is made from Nickel-Titanium alloy.
- 20 16. The vascular filter system according to claim 14, wherein said catheter is made from a polymeric material.
17. The vascular filter system according to claim 1, wherein said anti-migration means comprises hooks attached to said struts.
18. The vascular filter system according to claim 1, wherein said anti-migration means comprises the frictional force of a geometric design of said struts.
- 25 19. The vascular filter system according to claim 1, wherein said anti-migration means comprises a friction coating on said filter support structure.
- 30 20. The vascular filter system according to claim 1, wherein said anti-migration means comprises a surface treatment on said filter support structure.

21. The vascular filter system according to claim 1, wherein said retrieving means comprises a snare, and a snareable feature on said proximal end of said filter.
- 5 22. The vascular filter system according to claim 21, wherein said snare is made from Nickel-Titanium alloy.
- 10 23. The vascular filter system according to claim 1, wherein said retrieving means comprises a guidewire having an outer diameter, a proximal end and a distal end, said retrieving means further comprising a hook attached near said distal end of said guidewire and a hook attached near said proximal end of said filter.
- 15 24. The vascular filter system according to claim 23, wherein said hooks have c-shaped configurations.
- 20 25. The vascular filter system according to claim 23, wherein said hooks have t-shaped configurations.
- 25 26. The vascular filter system according to claim 1, wherein said retrieving means comprises a wire having an outer diameter, a proximal end and a distal end, said retrieving means further comprising a ball attached near said distal end of said wire and a receiver attached near said proximal portion of said filter.
- 30 27. The vascular filter system according to claim 1, wherein said retrieving means comprises a guidewire detachable from and attachable to said filter.
28. A method for capturing embolic particulates within a vascular filter in the lumen of a vessel, comprising the steps of:
- 35 a) providing a filter comprising a filter support structure, having a proximal portion, a distal portion, and a plurality of struts extending therebetween, said filter having a smaller first diameter for insertion into said lumen, and a second larger diameter for expanding to a diameter substantially equal to the diameter of said lumen and to be placed in a generally sealing relationship with said lumen; said filter further comprising a porous filter membrane attached to said filter distal portion and said plurality of struts; said filter further comprising anti-migration means for

- causing said filter to remain substantially stationary in said lumen of said vessel; said filter further comprising deploying and releasing means for causing said filter to be positioned in said lumen of said vessel, and to achieve said second larger diameter; said filter further comprising retrieving means for causing said filter to achieve said smaller first diameter and for removing said filter from said lumen;
- 5 b) deploying and releasing said filter past an occlusion in said lumen;
- 10 c) advancing additional interventional devices into said vessel and positioning said devices at the site of said occlusion in said vessel;
- 15 d) performing additional procedures to therapeutically treat said occlusion in said vessel;
- 15 e) capturing embolic particulates generated by said procedures in said filter;
- 15 f) removing said interventional devices from said guidewire; and
- 15 g) retrieving said filter.
- 20 29. A vascular filter system for insertion into a lumen of a vessel, said system comprising:
- 20 a) a filter support structure comprising a proximal portion, a distal portion, and a plurality of struts extending therebetween, said struts further comprising proximal portions and distal portions, said filter having a smaller first diameter for insertion into said lumen, and a second larger diameter for expanding to a diameter substantially equal to the diameter of said lumen and to be placed in a generally sealing relationship with said lumen;
- 25 b) a porous filter membrane connected to said filter distal portion and said plurality of struts;
- 25 c) deploying and releasing means operatively associated with said filter support structure, said deploying and releasing means causing said filter to be positioned at a specific location in said lumen of said vessel, and to achieve said larger second diameter;

- 5 said deploying means comprising a storage tube having an proximal end and a distal end and an inner lumen, with said distal end of said filter slidably insertable into said proximal end of said storage tube; said deploying means further comprising a catheter having an outer diameter and an inner diameter, a proximal end and a distal end, and an inner lumen, with said distal end of storage tube containing said filter slidably insertable into said proximal end of said catheter; said deploying means further comprising an obdurator having an outer diameter, a proximal end and a distal end, with said distal end of said obdurator slidably insertable into said proximal end of said storage tube until said distal end of said obdurator is substantially in contact with said proximal end of said filter, and said obdurator is positioned to push said filter into said proximal end of said catheter, through said lumen of said catheter, and out of said distal end of said catheter;
- 10 15 d) anti-migration means associated with said filter support structure, said anti-migration means causing said filter to remain substantially stationary in said lumen of said vessel, said anti-migration means comprising hooks attached to said struts; and
- 20 e) retrieving means operatively associated with said filter support structure, said retrieving means allowing recapture of said filter, causing said filter to achieve said first smaller diameter, and allowing removal said filter from said lumen; said retrieving means comprising a wire having an outer diameter, a proximal end and a distal end, said retrieving means further comprising a ball attached near said distal end of said wire and a receiver attached near said proximal portion of said filter.
- 25 30. A vascular filter system for insertion into a lumen of a vessel, said system comprising:
- 30 a) a filter support structure comprising a proximal portion, a distal portion, and a plurality of struts extending therebetween, said struts further comprising proximal portions and distal portions,

- said filter having a smaller first diameter for insertion into said lumen, and a second larger diameter for expanding to a diameter substantially equal to the diameter of said lumen and to be placed in a generally sealing relationship with said lumen;
- 5 b) a porous filter membrane connected to said filter distal portion and said plurality of struts;
- c) deploying and releasing means operatively associated with said filter support structure, said deploying means causing said filter to be positioned at a specific location in said lumen of said vessel, and to achieve said larger second diameter; said deploying means comprising a guidewire, with said proximal end of said filter releasably attachable near and detachable from said distal end of said guidewire; said deploying means further comprising a catheter having an outer diameter and an inner diameter, a proximal end and a distal end, and an inner lumen, with said proximal end of said guidewire slidably insertable into said distal end of said catheter until said catheter is coaxially disposed around said guidewire and said filter, and said catheter may be slidably retracted to deploy said filter;
- 15 d) anti-migration means associated with said filter support structure, said anti-migration means causing said filter to remain substantially stationary in said lumen of said vessel, said anti-migration means comprising a friction coating; and
- 20 e) retrieving means operatively associated with said filter support structure, said retrieving means allowing recapture of said filter, causing said filter to achieve said first smaller diameter, and allowing removal of said filter from said lumen; said retrieving means comprising a wire having an outer diameter, a proximal end and a distal end, said retrieving means further comprising a hook attached near said distal end of said wire and a hook attached near said proximal end of said filter.
- 25 31. The vascular filter system according to claim 30, wherein said hooks have c-shaped configurations.

32. The vascular filter system according to claim 30, wherein said hooks have t-shaped configurations.
33. A vascular filter system for insertion into a lumen of a vessel, said system comprising:
- 5 a) a filter support structure comprising a proximal portion, a distal portion, and a plurality of struts extending therebetween, said struts further comprising proximal portions and distal portions, said filter having a smaller first diameter for insertion into said lumen, and a second larger diameter for expanding to a diameter substantially equal to the diameter of said lumen and to be placed in a generally sealing relationship with said lumen;
- 10 b) a porous filter membrane connected to said filter distal portion and said plurality of struts;
- 15 c) deploying and releasing means operatively associated with said filter support structure, said deploying and releasing means causing said filter to be positioned at a specific location in said lumen of said vessel, and to achieve said larger second diameter; said deploying means comprising a catheter having an outer diameter and an inner diameter, a proximal end and a distal end, and an inner lumen, said deploying means further comprising a shaft having an outer diameter, a proximal end and a distal end, with said filter attached near said distal end of said shaft, and said catheter coaxially disposed around said shaft and said filter, such that said catheter may be slidably retracted to deploy said filter;
- 20 d) anti-migration means associated with said filter support structure, said anti-migration means causing said filter to remain substantially stationary in said lumen of said vessel, said anti-migration means comprising the chronic outward force of Nickel-Titanium alloy; and
- 25 e) retrieving means operatively associated with said filter support structure, said retrieving means allowing recapture of said filter, causing said filter to achieve said first smaller diameter, and

allowing removal said filter from said lumen; said retrieving means comprising a snare and a snareable feature on said proximal end of said filter.

34. A device for use with an emboli-capturing vascular filter, the improvement comprising:

5 anti-migration means associated with said filter, said anti-migration means causing said filter to remain substantially stationary in said lumen of said vessel.

35. A device for use with an emboli-capturing, guidewire-based, vascular filter, the improvement comprising:

10 anti-migration means associated with said filter, said anti-migration means causing said filter to remain substantially stationary in said lumen of said vessel.

36. A device for use with an emboli-capturing vascular filter, the improvement comprising:

15 retrieving means operatively associated with said filter, said retrieving means allowing recapture and removal of said filter from said lumen.